Preparing for the Future: How Asset Management Will Evolve in the Age of Smart Grid

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Introduction

Efficient management of utility assets has always been a priority for utilities. As a means of improving reliability and profitability, taking care to build and maintain plant at an appropriate level of quality and investment. Balancing operating expenses and capital costs to deliver the best value for utility customers and shareholders is the major objective of asset management. The task has grown in complexity, with the spiraling cost of new and replacement plant. Most utilities use some form of automation to address the problem, tailored to the unique business processes of building and maintaining plant.

The advent of the Smart Grid adds at least two dimensions to the asset management problem. First, there are number of new types of monitoring and control devices that are or will be added to the network, from substation and line sensing to smart meters. The asset models of many utilities will have to be expanded to add these new entities, while the definition of some existing assets, like newly-enable smart switches, will change. Second, the definition of a critical asset will evolve, and will undoubtedly grow to include more of the distribution grid.

Can the existing asset management systems and practices in use today adapt and expand to meet Smart Grid needs? And examination of that question is the goal of this brief paper. In it, we intend to survey the current state of asset management tools, briefly recap the requirements imposed by Smart Grids, and describe an approach that will lead asset owners to more unified, efficient asset management practice to meet the needs of a smarter grid.

The State of Asset Management in Utilities Today

Asset owners use a variety of software tools to manage their utility plant, summarized below. Each of these tools has a different business application, although some overlap in functionality:

Asset / Work Management Systems – These systems concentrate on record-keeping and asset lifecycle tracking, including the work resources applied to construct and maintain plant.

Fixed Asset Accounting – Fixed asset systems manage the property records of the business from a financial value standpoint.

GIS – These systems are used to layout (design) new facilities, track as-built assets through a lifecycle generate maps and sketches, and model the relationships of assets to the electrical network.

Planning Systems – Utilities utilize a variety of planning software solutions to model the network and analyze its performance under existing and projected load conditions.

SCADA – These systems maintain sufficient asset information to enable dispatchers to operate the network in "real-time" (within a second of actual occurrence in the field).

DMS – Combining the network model and analytics of the planning tool with the real-time infrastructure and control of the SCADA system, DMS allows system operators to make more intelligent operational decisions, or in some cases, makes those decisions automatically.

The use of disparate, often 'siloed' systems often leads to sub-optimal asset performance. Typically, legacy systems are implemented independently from each other, and by different parts of the utility, to meet different business needs. Assets tend to be replicated in many systems, leading to a host of gaps, errors, and inefficiencies.

Asset owners have responded with various solutions, including integrating (or attempting to) the various IT systems that model assets, or implementing a cross-cutting enterprise resource planning system (ERP) in an attempt to develop a single system-of record for the asset. Some worked well, and others well enough, and still others, not so well at all. But as the Smart Grid era approaches, pressure to improve even the best asset management practice will only intensify.

Enter the Smart Grid

Beginning just a few short years ago, a confluence of industry and political/economic factors culminated in the movement now known as the Smart Grid. At the highest level, the most important drivers motivating a more intelligent grid include:

Demand patterns are changing – Growth in electrical energy use, from computer loads to electric vehicles, to generally-increasing reliance on electric energy, has put pressure on all aspects of the grid. Many utility customers are seeking to know more about, and even to control, their electrical energy usage.

Generation is becoming more distributed – Distributed, "green" generation is growing throughout the world as a result of environmental concerns, advancing technology, and economics. This adds more complex assets to the distribution network, and creates challenges around operating those assets in a reliable and sustainable manner.

Reliability requirements are growing – As the cost of outages and poor service increase, even the most reliability-focused utilities are concentrating on improving or maintaining performance. To enable greater visibility, additional telemetry devices are being deployed on the distribution network. There is a

strong movement to add intelligent switching to the distribution network to support "self-healing" operations, to balance load, and to resolve outages more quickly.

Operating efficiencies are even more attractive – As the cost for new plant increases, and the political and economic environments make more generation capacity less viable, utilities are seeking to squeeze ever more performance out of the existing plant. With minimal upgrades, adding more sophisticated analysis and control can enable utilities to operate within narrow parameters, optimizing use of network assets.

These drivers imply that a large number of new distribution assets will be added, including substation, feeder, and end-point devices, and the telecommunications infrastructure that transmits real- and near-real-time data to the utility. The result is a rapid growth in additional assets in the distribution network with ancillary attributes not generally seen before. Added to volume is the increased frequency of plant changes in the network, straining the ability of traditional asset management tools.

Working Toward A Single Version of the Truth

The legacy approach to asset management through use of multiple, diverse, interfaced systems and (hopefully) synchronized databases will likely be unable to manage the requirements placed on utilities to operate their distribution networks in a smarter way. In the dynamic smart grid world, it will no longer be feasible to rely on disparate technology systems with large numbers of interfaces, or to have multiple instances of assets that require constant synchronization. To streamline the asset management process, utilities should work towards achieving "a single version of the truth" for asset-intensive software applications. Establishing a single instance of an asset and managing updates through a unified process is the goal of this vision.

"A single version of the truth" does not mean that utilities need have only a single physical database containing all assets. With all of the software applications and organizational dynamics involved, complete consolidation is not a practical reality in the near-term. Instead, utilities should strive to reduce the number of physical databases and implement strong business processes to update data as new information is received. Managing assets should include managing data about assets. The overarching goal should be to ensure data integrity across the enterprise.

Implementing this concept implies both new technology and workflows. Creation of a single system of record, with integration and process control to ensure consistency is a daunting task. But the payoff will be reduced cost, and increased accuracy and timeliness of the data required to support a smarter grid. Following are four key improvements to support their asset management efforts in the age of Smart Grid.

Development of a corporate data model for assets – Getting a single view of the asset is critical to managing it for optimal smart grid performance. Each disparate asset system has grown a data model to meet specific requirements; an effort to harmonize entities and attributes will pay huge dividends in network management. And, if the corporate model can be an extended version of an industry standard, such as the CIM or MultiSpeak, benefits for implementing more standardized technology will multiply.

Elimination of the use of "special purpose" databases for smart grid assets – Utilities should consider focusing in on a single asset platform. As an example, many utilities use same asset management software for power equipment. With some work, that application could be implemented to manage the additional assets that come along with the Smart Grid era, including smart devices, communications equipment, and the equipment needed to manage distributed generation. Consolidation will not be pain free, but will reduce the number of systems involving asset management, streamline the business processes, and greatly simplify the IT environment.

Establishment of a workflow management tool to support database updates – Utilities should establish the process for asset data update, and then use workflow tools to ensure that the single change in an asset is replicated across other databases that contain the same asset. For example, when a pole is replaced, an update to the spatial database should also trigger an update to the asset management and fixed asset accounting systems. More important for smarter grid operations is the network mode; for planning and SCADA systems should be synched as well. And that update cycle should be implemented for as-built and as-operated changes, so that if a normally-open switch is closed, the change in the network configuration should be made immediately. That would enable software to evaluate the state of the distribution network based on the new configuration.

Establishment of spatial databases as the key to the management of smart grid asset information –Today's database technology manages today's asset information reasonably well, but the needs of smart grid suggest that a spatial perspective of network asset data will be more useful. Using spatial technology enables utilities to more readily manage the connectivity of both as-built and as-operated networks based on manually entered, automated, or telemetered data. Modern GIS tools include design functionality to manage asset lifecycle, and the ability to provide mobile applications for field personnel to support rapid data update. Connectivity and network topology are far more easily represented and maintained in a spatial database context, ensuring the data integrity necessary to support 'a single version of the truth'.

Summary

The era of the Smart Grid is creating significant additions to utility infrastructure in the form of substation, feeder, and end-point devices. And the Smart Grid concept is challenging our notion of how dynamic asset management will occur in the industry. It won't be easy, but forward-thinking utilities can develop plans to move towards an approach in which asset data and the processes to update that data must evolve to "a single version of the truth". Leveraging a corporate asset model, as well as spatial and work flow technologies, will help bring asset management to a new level of functionality, enabling the industry to realize the benefits of the era of Smart Grid.